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Quantifying above-cloud aerosols through integrating multi-sensor
measurements from A-Train satellites

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Abstract

Quantifying above-cloud aerosols can help improve the assessment of aerosol intercontinental transport and climate impacts. Large-scale measurements of aerosol above low-level clouds had been generally unexplored until very recently when CALIPSO lidar started to acquire aerosol and cloud profiles in June 2006. Despite CALIPSO's unique capability of measuring above-cloud aerosol optical depth (AOD), such observations are substantially limited in spatial coverage because of the lidar's near-zero swath. We developed an approach that integrates measurements from A-Train satellite sensors (including CALIPSO lidar, OMI, and MODIS) to extend CALIPSO above-cloud AOD observations to substantially larger areas. We first examine relationships between collocated CALIPSO above-cloud AOD and OMI absorbing aerosol index (AI, a *qualitative* measure of AOD for elevated dust and smoke aerosol) as a function of MODIS cloud optical depth (COD) by using 8-month data in the Saharan dust outflow and southwest African smoke outflow regions. The analysis shows that for a given cloud albedo, above-cloud AOD correlates positively with AI in a linear manner. We then apply the derived relationships with MODIS COD and OMI AI measurements to derive above-cloud AOD over the whole outflow regions. In this talk, we will present spatial and day-to-day variations of the above-cloud AOD and the estimated direct radiative forcing by the above-cloud aerosols.